

found. An able lad gains much valuable knowledge, and, most important of all, self-knowledge, by contact with those who are his equals not only in talent but in years. It would be better, by a system of scholarships, to give the youth of country districts an opportunity of learning what competition means in a flourishing College, than to foster a large number of half-equipped and struggling institutions, which cannot reasonably hope to attract students of more than average capacity in numbers sufficient to justify their claim to being centres of the higher learning.

To encourage in their initial stages promising educational enterprises; to determine, if need be after fair trial, whether any given institution can do most good as a centre of elementary, secondary, or higher instruction; to afford to institutions of each grade help, the amount and continuance of which depend upon the educational results they attain and upon the increase or withdrawal of local support,—these are the general lines on which the State may aid secondary and higher education. It would thus encourage the performance of good work in each educational stage at those points where in the nature of things good work of that kind could best be done. It would be led no doubt into expenditure, but in this, as in so many other cases, the old induction holds good. "There is that scattereth and yet increaseth," is true of nations as of individuals, and most true of national expenditure on education.

PRACTICAL ZOOLOGY

An Elementary Course in Practical Zoology. By B. P. Colton, Instructor in Natural Sciences, Ottawa High School, Illinois. (Boston: D. C. Heath and Co., 1886.)

THIS volume is one of the latest additions to the stock of laboratory hand-books based upon the well-known type-system. It is more comprehensive, but, in detail, much simpler and more elementary, than any of its predecessors, while it differs from them in its method of treatment. The objects and scope of the work are set forth in a short introduction, and the detailed matter is embodied in thirty-two fasciculi, each devoted mainly to a consideration of some one type of organisation. Of these, ten are devoted to Insects and three to Crustacea—this, however, for a special purpose to which we shall allude. Practical hints dealing with methods and the like are incorporated with the text.

Certain emendations will be necessary in a subsequent edition, and to these we shall refer duly. In not a few cases the descriptions of the structural features of a given animal have been prefaced by a brief account of its habits and movements. An arrangement, this, of which we heartily approve. It must not be imagined, however, that the book stops short here. The author sets himself "to aid the student in getting a clear idea of the animal kingdom, as a whole, by the careful study of a few typical animals," and he reminds us that "a definition thought out by the student himself, imperfect though it be, is of more value to him than a perfect definition learned from a book, which often appeals to mere memory. Definitions made in the way these pages require are good as far as they go: they should be corrected and supplemented by the instructor. It develops a boy more to earn a dime than to receive a dollar as a gift."

The contents of the work are well arranged, the style is clear and concise, and the facts are presented in logical sequence, nothing being anticipated; but despite the assertion quoted above, there are far too few facts recorded. Some of the descriptions are meagre in the extreme, while others are so brief as to be useless. For example: on p. 8 the nervous system is introduced to the beginner for the first time (and that in the grasshopper) as consisting "mainly of a white cord extending along the floor of the whole body-cavity. In most of the abdominal rings the nerve-cord has enlargements called ganglia, from which nerves branch to the surrounding parts." The like is to be said of the descriptions of the spider's organs of respiration (p. 22), of the clam's kidney (p. 52), and other organs which could be named; while those of the dorsal vessel and "liver" of the earthworm demand early rectification. On p. 30 the author says of the "line of division between the head and thorax" in the crayfish:—"Huxley places it between the second pair of maxillæ and the first pair of maxillipeds. Hyatt places the division between the first and second pairs of maxillæ, as the space between these is membranous entirely across the sternal region, while back of this line the parts are hard and firmly soldered together." One primary object of a book of this kind should be that of imparting a sound training in methods by way of systematising the work of the student, and every conscientious teacher of zoology knows that by no means the least formidable difficulty to be encountered is that of teaching his pupils how much, and what, they shall leave aside. Bearing this in mind, we would fain see all matters which involve differences of opinion such as that alluded to above, eliminated from an elementary work.

The author has evidently been struck with the fact that there has manifested itself, under the growth of the type-system, a tendency to produce a lop-sidedness in the mind of the student. He is by no means alone here, but he sets himself to rectify the matter. This he does by extending and considerably modifying the said system; with what amount of success, has yet to be seen. He, and others who have since come into touch with him, must bear in mind that the type-book is, for the most part, but a tool in the hands of the student working (as does he for whom the author prescribes) under the guidance of a teacher, whose bounden duty it is personally to direct the work in all its details. He, and he alone, is to blame for this apparent defect.

One charge frequently brought against the type-system is that of apparent neglect of classification. The author meets this difficulty in a praiseworthy manner, by first describing a given animal as fully as his case demands, and then dealing with certain allied forms sufficiently to bring out the nature of those comparisons upon which our existing classifications are based. He introduces the subject of classification (p. 12) in an absolutely dogmatic and empirical manner, which, while it does not do justice to his intentions, exposes at the same time the dangers of the method adopted. He supplements the afore-mentioned chapter for chapter. Writing on p. 44, he says:—"Animals are ranked according to the number of things they can do, and do well. The earthworm has many parts, but they are nearly all alike, and do not enable it to do many different things. A part of an animal having a special

work to do is called an organ, and its work is its function. The earthworm has many organs, but few functions. Apply this principle to man and an ape. Each has four limbs. The ape is called four-handed, but has no good hands; he cannot handle things well. He has not good feet; he cannot walk well. What is the one thing he can do well with his four foot-hands? How many distinct functions has man with his hands and feet? Multiplication of parts without corresponding variety of structure and function mark an animal as low in rank." In striving for originality, the author has here gone astray; and with regard to the study of classification in all its branches, we are of opinion that it ought not to form a primary object in a work of purely educational value. For the advanced student, consideration of it must come as a matter of course sooner or later: for the beginner it is better that it be dealt with at the hands of the teacher, and that with the utmost caution.

On p. vi. of the introduction we read: "If the main object of this study is the mere acquisition of facts, full descriptions of most animals can be elsewhere obtained; but if the more important part in education is to lead the pupil to see and think for himself, then some such method as this" (above cited) "should be used." It is under the influence of this desire to "educate" the mind of the student that the author's plan is most novel and his labour most successful. One example will illustrate. On p. 124 the student is directed, when examining the lungs of the mammal, as follows: "Keeping the eyes fixed on the lung, prick a hole through one side of the diaphragm, and note the collapse of the lung." Then follows the question, "Is the lung on the other side affected by this operation?" A forcible means, this, of bringing home a fundamental fact of lung-structure, which, though so simple, is, as any teacher of experience knows to his sorrow, so generally overlooked by the beginner. It is here introduced in a manner which cannot fail to bring home conviction or to create a lasting impression; and the student who shall have thus learned it will some day wake up to the fact that he has made an important discovery. Many other charmingly simple examples of the kind might be cited. In one or two cases the idea is overdone. In others the student is misled for want of a technical term; and speculating upon the probable nature of the retort which might be in such a case elicited, the writer is reminded of a reply obtained from a beginner who had worked out most satisfactorily the mammalian portal vein, in ignorance of the conventional nomenclature. The question, "What do you call this vein?" was met by the rejoinder, "Stomacho-liver." More technical terms might, with advantage, be introduced into this book. The acquisition of a technical nomenclature must go hand in hand with that of the fundamentals of a science, and we are of opinion that, until such are rightly and fully mastered, the student must be, as a tool in the hands of his teacher, guided with an unflinching precision.

In consideration of the pernicious rubbish which, even yet, occasionally finds its way into our own elementary schools under the guise of the elementary text-book of science, it is pleasant to reflect upon the merits of this work. The author is fortunate in being unhampered with the everlasting syllabus; he performs his experiment in his own manner, and it is worthy of a fair trial. We

question, however, the advisability of making the study of insects the focal point. The author asserts that his work "has usually begun with the fall term. At this time insects are abundant, and many kinds may be easily collected; they therefore serve well to show how animals are classified." We presume, therefore, that he adopts the inevitable. He further claims that "insects are attractive: from insects the student passes on to forms which, if taken up at first, would perhaps be distasteful to him." This may be, but we doubt it. For the analogous use of flowers as a means of introduction to the study of botany much more is to be said. This book is written for special use upon special ground and under special circumstances; it forms part of a system, and its success can only be rightly judged by someone cognisant of the whole. The task which the author has in hand is one, of its kind, the most difficult, and at the same time the most pleasing, of which we can conceive. In it he is honoured, and his plan of work must, like all which have preceded it, have its shortcomings. That these will be made good with a ripening experience we doubt not.

It remains to call attention to one or two matters standing in need of immediate reconsideration. On p. 169 we find the heresy of the evaginated hydra revived, with much emphasis. P. 71 bears the extraordinary statement that "a fish whose body is flattened from side to side is said to be 'compressed'; the word 'flat,' when used in describing a fish, means flattened from above downwards, and is applied to such a fish as the flounder." Directions are given (p. 120) for injecting the blood-vessels of the mammal, but they are wholly superfluous, as more than that which is required for the purpose in hand can be made out without it, while the process is involved in difficulties which are beyond the pale of such elementary students.

The author's directions for killing most of the animals are surprisingly novel; those for despatching the turtle and pigeon being worthy of the modern executioner. P. 102 reads: "with a strong pair of pinchers seize the head" (of the turtle), "pull it well out, and chop it off; examine the mouth; are there teeth present?" No experienced zoologist needs to be reminded of the effects which this repulsive piece of butchery would produce; but even that pales beside the injunction (p. 105) to "open the pigeon's mouth, and insert a pipette containing about a teaspoonful of chloroform into the opening of the glottis, at the base of the tongue" (this has to be found by the student), "blow the chloroform into the lungs, being careful that the point of the pipette does not slip out of the glottis." Never was insult worse than this added to injury. These things must be speedily altered if intended for the juvenile who is "to see and think for himself."

G. B. H.

THE DUTCH COLONIES IN SOUTH AMERICA AND THE WEST INDIES

Westindische Skizzen: Reise-Erinnerungen. Von K. Martin, Professor für Geologie an der Universität zu Leiden. vii.-186 pp. 8vo, with 22 Plates and 1 Map. (Leiden: E. J. Brill, 1887.)

TOWARDS the close of 1884 several learned Societies in Holland granted collectively the means for a scientific mission to the Dutch colonies in South America